Observations and Reports (*continued*).
1888. 4to. *London* 1892; Report of the Conference at Munich. 8vo. *London* 1893; Report of the Meteorological Council. 1892. 8vo. *London* 1893. The Office.

Mersey. Report on the Present State of the Navigation of the River Mersey. 1892. 8vo. *London* 1893.
The Conservancy Commissioners.

Milan:—R. Osservatorio di Brera. Osservazioni Meteorologiche. 1891–92. 4to. *Milano.* The Observatory.

May 4, 1893.

The LORD KELVIN, D.C.L., LL.D., President, in the Chair.

A List of the Presents received was laid on the table, and thanks ordered for them.

In pursuance of the Statutes, the names of the Candidates recommended for election into the Society were read from the Chair as follows:—

Burnside, Professor William, M.A.
Dunstan, Professor Wyndham R., M.A.
Ellis, William, F.R.A.S.
Ewart, Professor J. Cossar, M.D.
Gairdner, Professor William Tennant, M.D.
Hobson, Ernest William, D.Sc.
Howorth, Sir Henry Hoyle, K.C.I.E.
Newton, Edwin Tulley, F.G.S.
Sherrington, Charles Scott, M.B.
Stirling, Edward C., M.D.
Thornycroft, John Isaac, M.Inst. C.E.
Trail, Professor James William Helenus, M.D.
Wallace, Alfred Russel, LL.D.
Worthington, Professor Arthur Mason, M.A.
Young, Professor Sydney, D.Sc.

The following Papers were read:—

I. "On the Thickness and Electrical Resistance of Thin Liquid Films." By A. W. REINOLD, M.A., F.R.S., Professor of Physics in the Royal Naval College, Greenwich, and A. W. RÜCKER, M.A., F.R.S., Professor of Physics in the Royal College of Science, London. Received March 10, 1893.

(Abstract.)

The paper gives an account of experiments made for the purpose of determining the thickness of black soap films formed of solutions

of varying composition. Two methods of experiment were employed: (1) an optical method, in which the mean thickness of about 50 plane black films contained in a tube was deduced from observations of interference phenomena; and (2) an electrical method, in which the thickness of a cylindrical black film was derived from a measurement of its electrical resistance. The optical method involves the assumption that the refractive index of a thin film of liquid is the same as that of a large quantity of the same liquid.

Reasons are given for the belief that the refractive indices in question, if not identical, differ only slightly, and hence that the thickness of a film as determined by the optical method is the true thickness.

In the electrical method the assumption is made that the specific conductivity of a liquid does not alter when the liquid is drawn out into a thin film.

If the results obtained by the two methods agree, the conclusion is that the specific resistance of a film is not affected by its tenuity; if they differ widely from each other, a change in the specific conductivity of the liquid must have taken place.

The authors showed, in 1883, that for a solution of hard soap containing 3 per cent. of KNO_3, with or without the admixture of glycerine, the mean thicknesses of black films, as measured by each of the two methods, were in close agreement. For such solutions, then, the specific conductivity is the same whether the liquid be examined in considerable bulk or in the form of a film 12 $\mu\mu$ in thickness. The accuracy of this result has been confirmed by a large number of observations made during the last three years.

If the proportion of KNO_3 added to the solution be diminished, the thickness of a black film, whether measured optically or electrically, is found to undergo a change.

I. *Optical Method.*

The following table shows the change in the (true) thickness of a black film due to a change in the quantity of dissolved salt.

1 part of Hard Soap in 40 of Water.

Percentage of KNO_3..........	3	1	0·5	0
Mean (true) thickness of black film in $\mu\mu$.................	12·4	13·5	14·5	22·1

Experiments made with soft soap and with solutions containing glycerine confirm these results.

The change in the mean thickness of a black film due to variation in the percentage of dissolved soap is shown in the following table:—

Hard Soap. No dissolved Salt.

Proportion of water to soap....	1/30	1/40	1/60	1/80
Mean thickness of black film in $\mu\mu$....................	21·6	22·1	27·7	29·3

When the solution contains 3 per cent. of KNO_3 variation in the proportion of dissolved soap has little influence on the thickness of a black film, as is evident from the following numbers:—

Hard Soap. 3 per cent. KNO_3.

Proportion of soap to water....	1/40	1/50	1/60	1/70
Mean thickness of black film...	13·0	12·1	11·55	12·1

II. *Electrical Method.*

It has been stated that for a soap solution containing 3 per cent. of KNO_3 the thickness of a black film as measured electrically is practically the same as that measured optically. If, however, the proportion of KNO_3 be diminished, the thickness (measured electrically) increased in a far larger ratio than would be inferred from the optical method. If the proportion of salt be diminished to zero, the thicknesses thus calculated are much greater than the greatest thickness at which a film can appear black. In such cases, therefore, the electrical method does not give the true thickness of the black, and the hypothesis that the specific conductivity of the film and of the liquid in mass are identical is untenable.

The following table shows the change in apparent thickness due to diminution in the quantity of dissolved salt:—

Hard Soap.

Percentage of KNO_3	3	2	1	0·5	0
Mean apparent thickness of black film (measured electrically)	10·6	12·7	24·4	26·5	154

The large value obtained for the apparent thickness in the case of

the unsalted hard soap solution is confirmed by experiments on a solution of unsalted soft soap, which gave a mean appearent thickness of 162 $\mu\mu$.

In different films the measured thicknesses of the black differ widely from each other, the limits being roughly 80 $\mu\mu$ and 230 $\mu\mu$. This large variation is due in some cases, at all events, to a real variation in the thickness. Two different shades of black are (in cases where the solution contains little or no salt) frequently seen in a film. They are separated from each other by a line of discontinuity which is irregular in shape. Comparative measurements on the two shades of black are difficult to make, as the regions they occupy are rarely sufficiently extended or separated by a line sufficiently approximating to a horizontal circle for the application of the method of measurement which the authors employ. Measurements, however, have been made, and the results indicate that the electrical thicknesses of the two kinds of black are approximately as 2 : 1.

Details are given in the paper of numerous experiments carried out with the object of determining the *cause of the great increase in electrical conductivity in black films made from unsalted soap solutions.*

The results have shown that the increase of specific conductivity in question—

1. Is independent of moderate changes of temperature.
2. Is not due to the absorption or evaporation of water by the film.
3. Is not due to change in the composition of the liquid by electrolytic decomposition produced by the current used to measure the electrical resistance of the film.
4. Is not affected by a very large change in the quantity of CO_2 in the air around the film.
5. Is practically unaltered if the films are formed in an atmosphere of oxygen.

The next question to be answered was whether the large changes in specific conductivity affect black films only, or whether similar phenomena can be detected in the case of thicker films.

The conclusions arrived at were (1) that the specific conductivity of a film increases as the thickness decreases and (2) that this increase is less in the case of a film to which a salt has been added and is *nil* when the proportion of salt is as much as 3 per cent. The following figures illustrate the first of these conclusions:—

Hard Soap 1/60.

Optical, *i.e.*, true, thickness of film in $\mu\mu$	641	296	97	27·7
Ratio of electrical to optical thickness..................	1·66	1·98	4·47	5·8

In the case of a soap solution containing 3 per cent. of KNO_3 the results of the electrical and optical methods of measurement agree for thicknesses greater than 450 $\mu\mu$. At thicknesses between 450 and 200 $\mu\mu$ the ratio is generally above unity, being in some cases as large as 1·28, but there is no clear indication that its value increases as the film thins, and when the thickness corresponding to the black is reached the ratio is again unity.

The paper concludes with a discussion as to the cause of the increase of electrical conductivity in thin films. The authors point out that it may be attributed either to a modification of the chemical constitution of the film brought about by its tenuity, or to the formation of a pellicle on the surface. They prove that the experimental results cannot be explained by the formation of a pellicle only, but that they are consistent either with the former or with a combination of both causes. To discriminate between them it will be necessary to carry out observations in gases other than air, and an apparatus specially designed for this purpose is being constructed.

II. "Organic Oximides: a Research on their Pharmacology." By H. W. Pomfret, M.D., F.R.C.S., late Berkeley Fellow at the Owens College. Communicated by Sir Wm. Roberts, F.R.S. Received March 6, 1893.

(Abstract.)

Organic oximides may be concisely defined as "bodies containing the chemical group $=N\cdot OH$ attached to a carbon atom."

These bodies may be broadly divided into two classes: (*a*) Those whose preparation involves the use of hydroxylamine; these are known as "oximes," whence the generic name "oximide" is derived. (*b*) Those which are prepared independently of hydroxylamine. These latter may be obtained by the aid of nitrous acid, and have been termed "isonitroso-" bodies. This group $=N\cdot OH$ must be distinguished from the true "nitroso-" group $-NO$. The oxime group is bivalent, being regarded as a compound of trivalent nitrogen with the monovalent radical hydroxyl. The true nitroso-group is monovalent, two "affinities" of the nitrogen being taken up by oxygen.

There is furthermore an essential structural difference between the bodies forming the subject of this research and the nitrites. In the nitrites the nitrogen is attached to oxygen, whereas in these oximido-bodies the nitrogen of the oxime group is attached to carbon, and the larger group "$C=N\cdot OH$" may be considered present.